

The Cottage in the Wall, Dawley Road, Hayes

Drainage Strategy Report

Doc. Ref: 076625-CUR-00-XX-RP-C-00002

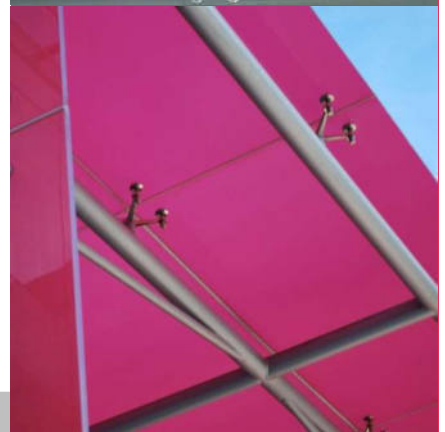
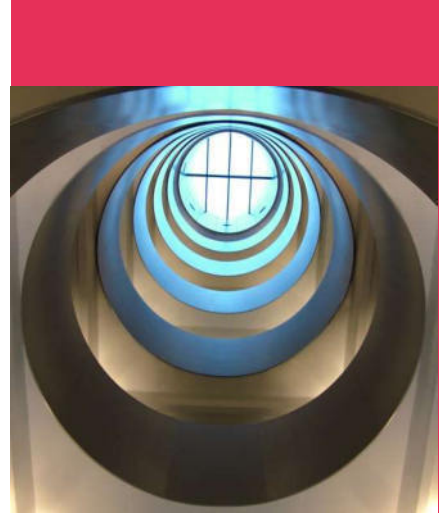
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V01	Issue	DJ	AF	10.11.2020
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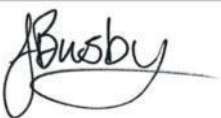
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1.0 Introduction

1.1 Project Background

Curtins has been appointed by Abellio London to prepare a Drainage Strategy Report in support of the planning application 'The Cottage in the Wall, Dawley Road, Hayes'.

The planning application is for the proposed bus depot development (Sui Generis Use) and associated office space (Class E).

The site is located on the land off Dawley Road, Hayes, UB3 1EF.

The site is located to the west of Dawley Road and north of Lord Builders Merchants Building. The west and northern perimeter of the site are located adjacent to Stockley Park Golf Club.

The report is based on currently available information.

The proposals for the surface water management strategy are based on the requirements London Plan Policy 5.13 and of Hillingdon Council in their role as Lead Local Flood Authority (LLFA).

London Plan Policy 5.13 Sustainable Drainage states that development should utilise SuDS unless there are practical reasons for not doing so, and should aim to achieve greenfield runoff rates and ensure that surface water runoff is managed as close to its source as possible in line with the following drainage hierarchy:

1. Store rainwater for later use
2. Use infiltration techniques, such as porous surfaces in non-clay areas
3. Attenuate rainwater in ponds or open water features for gradual release
4. Attenuate rainwater by storing in tanks or sealed water features for gradual release
5. Discharge rainwater direct to a watercourse
6. Discharge rainwater to a surface water sewer/drain
7. Discharge rainwater to a combined sewer

Proposals contained or forming part of this report represent the design intent and may be subject to alteration or adjustment in completing the detailed design of this project. Where such adjustments are undertaken as part of the detailed design and are deemed a material deviation from the content contained in this document, prior approval shall be obtained from the relevant authority in advance of commencing such works.

In April 2015, the Government made changes to the NPPF which made Sustainable Urban Drainage Systems (SuDS) a material consideration in the determination of planning applications for 'Major' developments.

A detailed drainage strategy will therefore be required as part of the planning application as the site is considered to be a 'Major Development' by the Town & Country Planning Order 2015.

This report is to be read in conjunction with the project FRA.

1.2 Existing Drainage

1.2.1 Public Drainage

Public sewer records have been obtained for the development site from Thames Water (TW). There is an existing 675mm surface water sewer located within Dawley Road that flows in a south east direction.

There is an existing 450mm foul sewer located within the junction of Dawley Road with Botwell Common Road that flows in a north east direction along Botwell Common Road.

1.2.2 Private Drainage

The topographical survey highlights evidence of existing drainage within the development with RWP connections, inspection chambers and manholes highlighted within the site.

A GPR survey was completed within the highway adjacent to the development with no positive outfall connections confirmed for the discharge of drainage within the site into the public sewers located within Dawley Road.

An existing cess pit is located within the site which is expected to collect surface and foul water flows.

2.0 Drainage Strategy

2.1 Proposed Foul Water Drainage

The foul drainage flows from the development are proposed to be collected by new private foul drains. Foul flows will need to be pumped to the existing foul sewer located within the junction of Dawley Road with Botwell Common Road.

Due to the number of facilities proposed within the development including a re-fuelling island, bus and engine wash, foul water will be treated within a number of treatment stages within the development prior to discharge in accordance with current guidance

A pre-development enquiry has been submitted to Thames Water at the time of writing of the Flood Risk Assessment, outfall location and discharge rate subject to agreement.

2.2 Proposed Surface Water Drainage

Any new development site drainage should be designed in accordance with current best practice to provide adequate capacity not to flood for the critical 1 in 30 (3.3%) Annual Probability storm event and flood water generated for the critical 1 in 100 (1%) Annual Probability plus climate change storm event shall be constrained within the site boundary and not cause damage to buildings, essential services or adjoining developments.

The most appropriate method of surface water discharge has been determined based on the hierarchy of surface water disposal set out in Building Regulations – Approved Document H and the London Plan Policy 5.13.

Store rainwater for later use

In following the London Plan policy 5.13 hierarchy of drainage solutions, consideration should firstly be given to the storage of water for re use. It is proposed that the new office building shall include a green roof to capture and re use rainwater. For green roof details refer to **Appendix B**.

Infiltration

Consideration should be given to the discharge of surface water run-off by infiltration.

The online BGS 1:50,000 scale superficial geology maps indicate the site is underlain by Boyn Hill Gravels (sands and gravels. As part of ground investigations made ground was found at varying depths

across the development. Perched groundwater was found at shallow depths with hydrocarbon contamination also found within trial pits across the development therefore infiltration is confirmed unsuitable.

Watercourse

There is no watercourse or suitable waterbody within the vicinity of the site.

Private Surface Water Sewer

There are no existing surface sewers located within the site that outfall into the adjacent public sewer located in Dawley Road.

Public Surface Water Sewer

There is an existing 675mm surface water sewer located within Dawley road. A pre-development enquiry has been submitted to Thames Water and have confirmed surface water can discharge at a maximum restricted rate of 3l/s . Runoff calculations for the site show that current **Greenfield runoff** is **2 l/s**. To comply with the London Plan Policy 5.13, runoff shall be restricted to the **Greenfield runoff rate of 2 l/s**.

Combined Sewer

There are no combined sewers suitable for discharge.

Summary

The surface water strategy complies with the London Plan Policy 5.13

Refer to **Appendix A** for drainage strategy plan details.

The proposed building shall include a green roof. **Refer to Appendix B**

The site will discharge surface water via the existing public sewer within Dawley Road.

A pre-development enquiry has been submitted to Thames Water and have confirmed surface water can discharge at a maximum restricted rate of 3l/s . The discharge from the site will be restricted to **Greenfield runoff** which is calculated to be **2 l/s**. For calculations **refer to Appendix C**.

2.3 Attenuation

The site is 0.39ha in development area. As flow from the site is restricted to 2l/s an aspect of on-site attenuation will be required to ensure flooding does not occur or is managed on site in the 100 year + 40% climate change events.

Due to site constraints including the future proposed site use, cellular storage is to be implemented for on site attenuation.

2.4 Drainage calculations

Drainage calculations have been carried out and show that no flooding occurs for the 1 year and 30 year event. Minor flooding of the system is predicted for the 100 year + 40% climate change event. For **Drainage calculations refer to Appendix D.**

2.5 Flood Exceedance

Drainage calculations included in Appendix D show that 1.6 m3 flooding of the system is predicted for the 100 year + 40% climate change event. The location of the predicted flooding is situated within a below ground stone infill tree root protection zone. As such, no above ground flooding is predicted for the scheme. The extents of flooding within the stone area will be retained within the limits of the site and is shown on the **Flood Exceedance plan in Appendix E**

2.6 Water Quality

The SuDS design for the development will ensure that the quality of any receiving water body is not adversely affected and preferably enhanced in accordance with CIRIA SuDS Manual C753, Chapter 4.

The final strategy for pollution control will be confirmed as part of the detailed design, however at this stage of the assessment the provision of proprietary interceptors will be used as treatment for surface water flows.

2.7 Management and Maintenance of the Scheme

A suitable maintenance strategy should be adopted to ensure the drainage network is cleaned regularly and the routine maintenance and cleansing regime should be documented.

CIRIA SUDS Manual (2015) provides guidance on the maintenance and operational requirements for typical SUDS components.

The attenuation tank and interceptors will require regular inspections, carried out monthly for the first year of operation and after significant storm events, to ensure the system is functioning as required and that no damage is present. The typical points to check will include:

- Inlets and outlets are not blocked and are flowing freely.
- If there is any sediment build-up that will need clearing.
- If there's any evidence of oil accumulation.
- For the presence of any litter or other debris that will need removing.
- Any structural damage that needs repair.

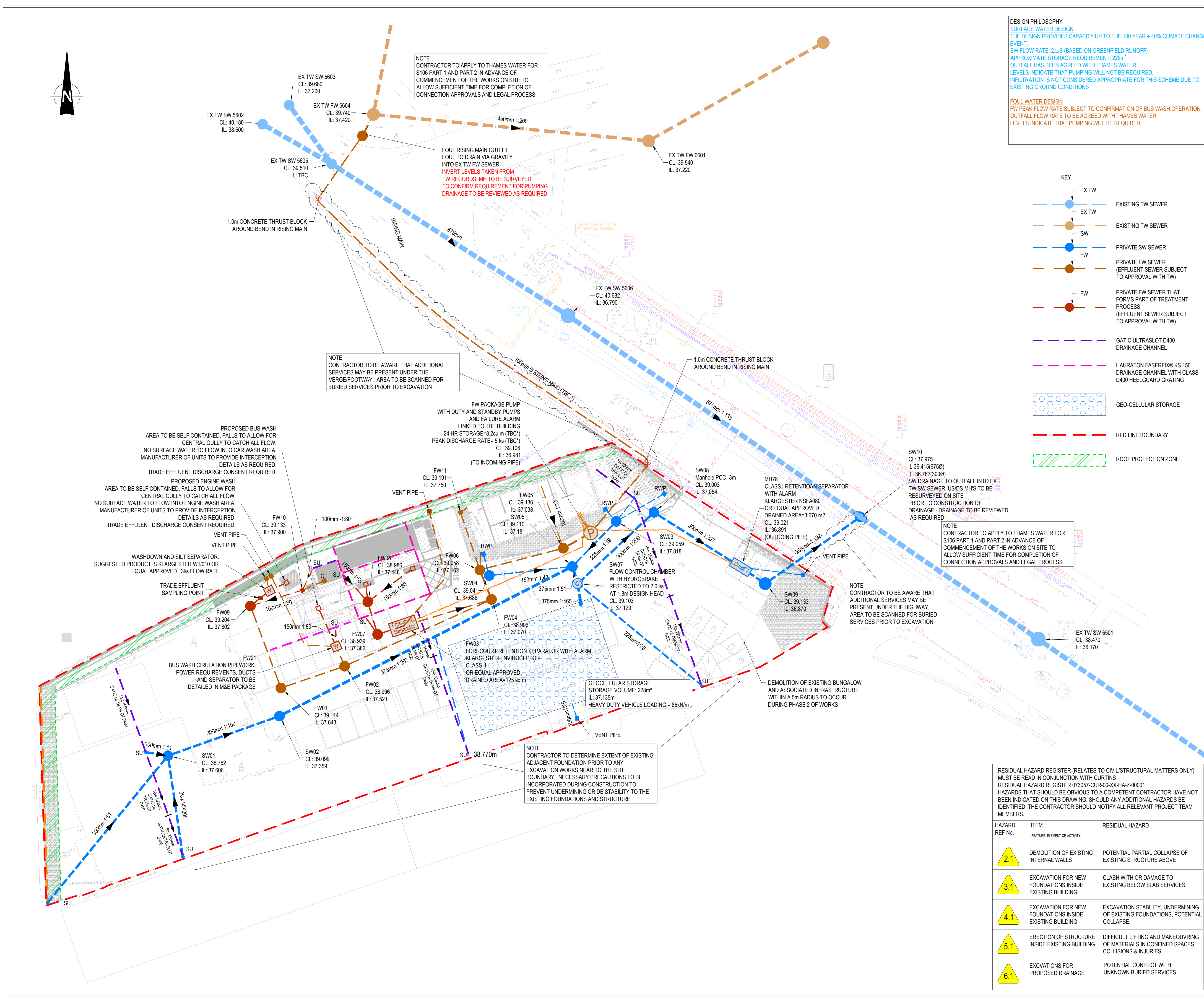
The maintenance contractor, or individual(s) otherwise responsible for inspection and maintenance of surface water system, should keep a record of when the areas were inspected, what the outcome of the inspection was and whether any remedial works were carried out. Certain issues, or frequency of issues, may indicate the need for further investigation.

2.8 Measures to minimise water use

Wash plant shall be provided in the scheme with a water reclamation system. The system shall be designed to ensure a continuous supply of recycled wash water.

3.0 Appendices

3.1 Appendix A – Proposed Drainage Layout



KEY

- EX TW: EXISTING TW SEWER
- EX TW: EXISTING TW SEWER
- SW: PRIVATE SW SEWER
- FW: PRIVATE FW SEWER (EFFLUENT SEWER SUBJECT TO APPROVAL WITH TW)
- FW: PRIVATE FW SEWER THAT FORMS PART OF TREATMENT PROCESS (EFFLUENT SEWER SUBJECT TO APPROVAL WITH TW)
- GATIC ULTRASLOT D400 DRAINAGE CHANNEL
- HAURATON FASERFIX® KS 150 DRAINAGE CHANNEL WITH CLASS D400 HEELGUARD GRATING
- Geo-CELLULAR STORAGE
- RED LINE BOUNDARY
- ROOT PROTECTION ZONE

- | | | | | |
|------|---------------------------------------|----------|-----|-------|
| P06 | UPDATED FOR PLANNING | 16/03/21 | MB | RT |
| P05 | AMENDED FOR FINAL TENDER ISSUE | 26/02/21 | RT | JK |
| P04 | ISSUED FOR TENDER | 19/02/21 | MB | RT |
| P03 | REVISED TO RELOCATE CLASS 1 SEPARATOR | 02/11/20 | RT | AF |
| P02 | REVISED FOR PLANNING PURPOSES | 27/10/20 | AF | JDB |
| P01 | ISSUED FOR COSTING | 11/08/20 | RT | RT |
| Rev: | Description | Date | By: | Chkd: |
| | | | | |

RESIDUAL HAZARD REGISTER (RELATES TO CIVIL/STRUCTURAL MATTERS ONLY) MUST BE READ IN CONJUNCTION WITH CURTINS RESIDUAL HAZARD REGISTER 073057-CUR-00-XX-HA-Z-00001. HAZARDS THAT ARE OBVIOUS TO A COMPETENT CONTRACTOR SHOULD NOT BE INDICATED ON THIS DRAWING. SHOULD ANY ADDITIONAL HAZARDS BE IDENTIFIED, THE CONTRACTOR SHOULD NOTIFY ALL RELEVANT PROJECT TEAM MEMBERS.		
HAZARD REF No.	ITEM (FEATURE, ELEMENT OR ACTIVITY)	RESIDUAL HAZARD
	DEMOLITION OF EXISTING INTERNAL WALLS	POTENTIAL PARTIAL COLLAPSE OF EXISTING STRUCTURE ABOVE
	EXCAVATION FOR NEW FOUNDATIONS INSIDE EXISTING BUILDING	CLASH WITH OR DAMAGE TO EXISTING BELOW SLAB SERVICES.
	EXCAVATION FOR NEW FOUNDATIONS INSIDE EXISTING BUILDING	EXCAVATION STABILITY, UNDERMINING OF EXISTING FOUNDATIONS, POTENTIAL COLLAPSE.
	ERECTION OF STRUCTURE INSIDE EXISTING BUILDING.	DIFFICULT LIFTING AND MANOEUVRING OF MATERIALS IN CONFINED SPACES, COLLISIONS & INJURIES.
	EXCAVATIONS FOR PROPOSED DRAINAGE	POTENTIAL CONFLICT WITH UNKNOWN BURIED SERVICES

3.2 **Appendix B Green Roof Sections**

Bio-Diverse Green Roof
Subject to Contractor Design portion
Typical specification obtained from Blackdown Greeroof Systems.
System comprises of
- Blackdown Vegetation – mixture of wildflower plug plants and/or seed
- Blackdown Habitat Incidentals – shelter stones, lying timbers, perches, piles of mixed aggregates
- Blackdown Substrate – 80-200mm blend of organic and non-organic materials
- Blackdown Filter Sheet – 110g polypropylene filter sheet
- Blackdown Drainage Layer – 40mm, cusped, recycled HDPE
- Blackdown Protection Fleece – 300g polypropylene protection fleece

Roof Construction
> Roof structure by structural engineer. To accommodate weight of Bio-Diverse roof system - estimated to be 2.04kN per square meter (saturated) - to be confirmed by specialist sub-contractor.
> 18mm WBP Plywood to EN314-2: Class 3.
> Euroroof Self-Adhesive Vapour Barrier Plus
> 100mm Alumasac GTF Bonded in PU Adhesive
> Euroroof Thermo-Adhesive Underlay (Bonded by application of Cap sheet)
> Euroroof Mastergold Anti-Root
> Biodiverse layer over - See Biodiverse Roof note above.
All to be installed strictly in accordance with manufacturers recommendations and details.

Roof Insulation
Target U-Value 0.25W/m2.K.
Calculations provided by Alumasac Roofing Systems. 100mm Alumasac GTF combined with the 18mm plywood provides a U-Value of 0.23W/m2.K.

See GA Floor Plan drawing 1051-120 for external wall construction information.

First Floor Construction
> 200mm thick precast hollowcore floor. To structural engineer's details.

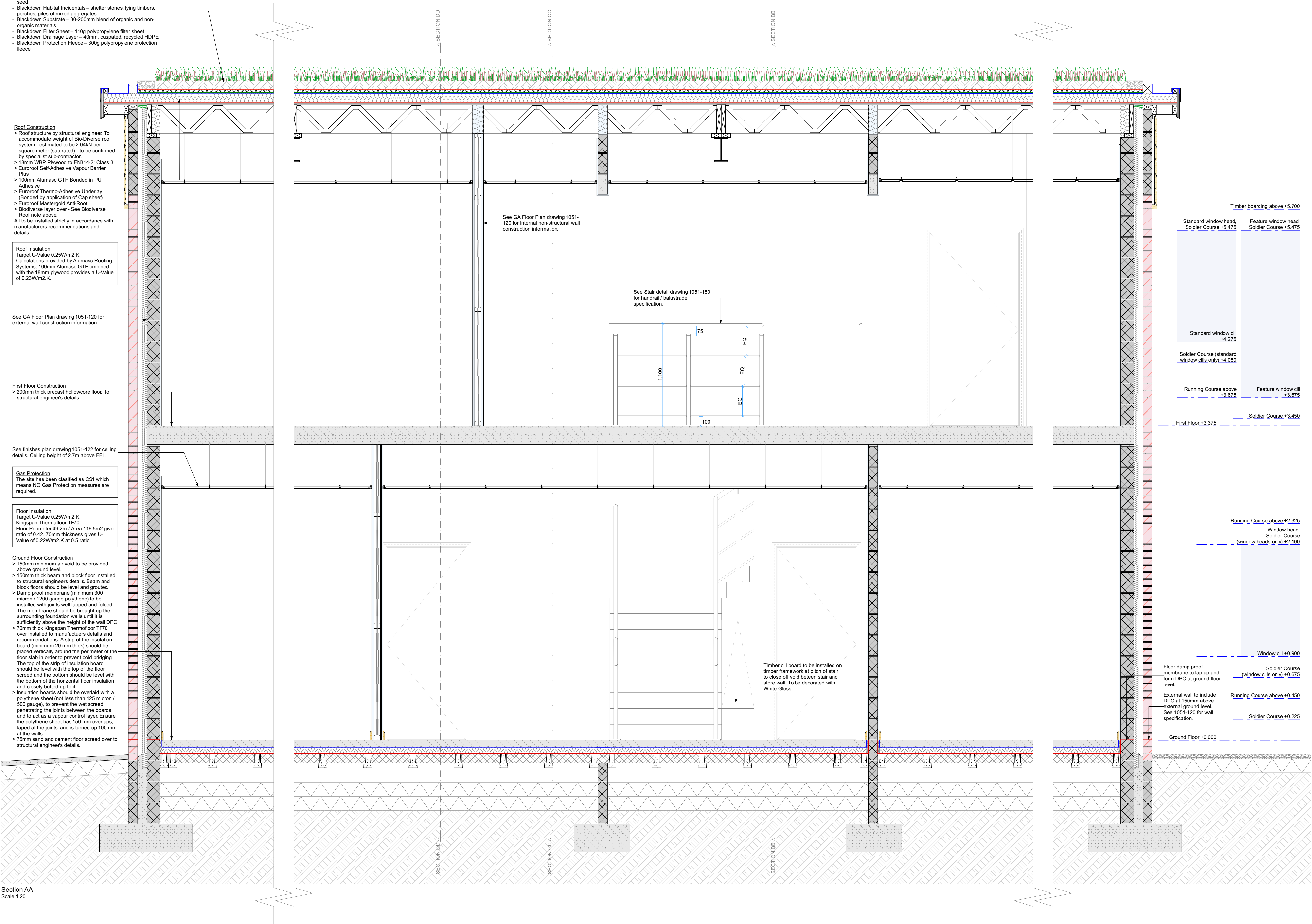
See finishes plan drawing 1051-122 for ceiling details. Ceiling height of 2.7m above FFL.

Gas Protection
The site has been classified as CS1 which means NO Gas Protection measures are required.

Floor Insulation
Target U-Value 0.25W/m2.K.
Kingspan Thermafloor TF70
Floor Perimeter 49.2m / Area 116.5m2 give ratio of 0.42. 70mm thickness gives U-Value of 0.22W/m2.K at 0.5 ratio.

Ground Floor Construction
> 150mm minimum air void to be provided above ground level.
> 150mm thick beam and block floor installed to structural engineers details. Beam and block floors should be level and grouted.
> Damp proof membrane (minimum 300 micron / 1200 gauge polythene) to be installed with joints well lapped and folded. The membrane should be brought up the surrounding foundation walls until it is sufficiently above the height of the wall DPC
> 70mm thick Kingspan Thermafloor TF70 over installed to manufacturers details and recommendations. A strip of the insulation board (minimum 20 mm thick) should be placed vertically around the perimeter of the floor slab in order to prevent cold bridging. The top of the strip of insulation board should be level with the top of the floor screed and the bottom should be level with the bottom of the horizontal floor insulation and closely butted up to it.
> Insulation boards should be overlaid with a polythene sheet (not less than 125 micron / 500 gauge), to prevent the wet screed penetrating the joints between the boards, and to act as a vapour control layer. Ensure the polythene sheet has 150 mm overlaps, lapped at the joints, and is turned up 100 mm at the walls.
> 70mm sand and cement floor screed over to structural engineer's details.

Section AA
Scale 1:20



Timber boarding above +5.700	
Standard window head, Soldier Course +5.475	Feature window head, Soldier Course +5.475
Standard window cill +4.275	
Soldier Course (standard window cills only) +4.050	
Running Course above +3.675	Feature window cill +3.675
First Floor +3.375	
Soldier Course +3.450	

Running Course above +2.325	Window head, Soldier Course
(window heads only) +2.100	

Window cill +0.900	Soldier Course (window cills only) +0.675
Running Course above +0.450	
Soldier Course +0.225	
Ground Floor +0.000	

Floor damp proof
membrane to lap up and
form DPC at ground floor
level.
External wall to include
DPC at 150mm above
external ground level.
See 1051-120 for wall
specification.

Revision	Description	Date
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Client

abellio
london

Project

Proposed Depot for Abellio London
Dawley Road
Hayes, UB3 1EF

Drawing Title

Accom - Proposed Section AA

JANUS
ARCHITECTURE

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ARCHITECTURAL DESIGN
PRINCIPAL DESIGNER

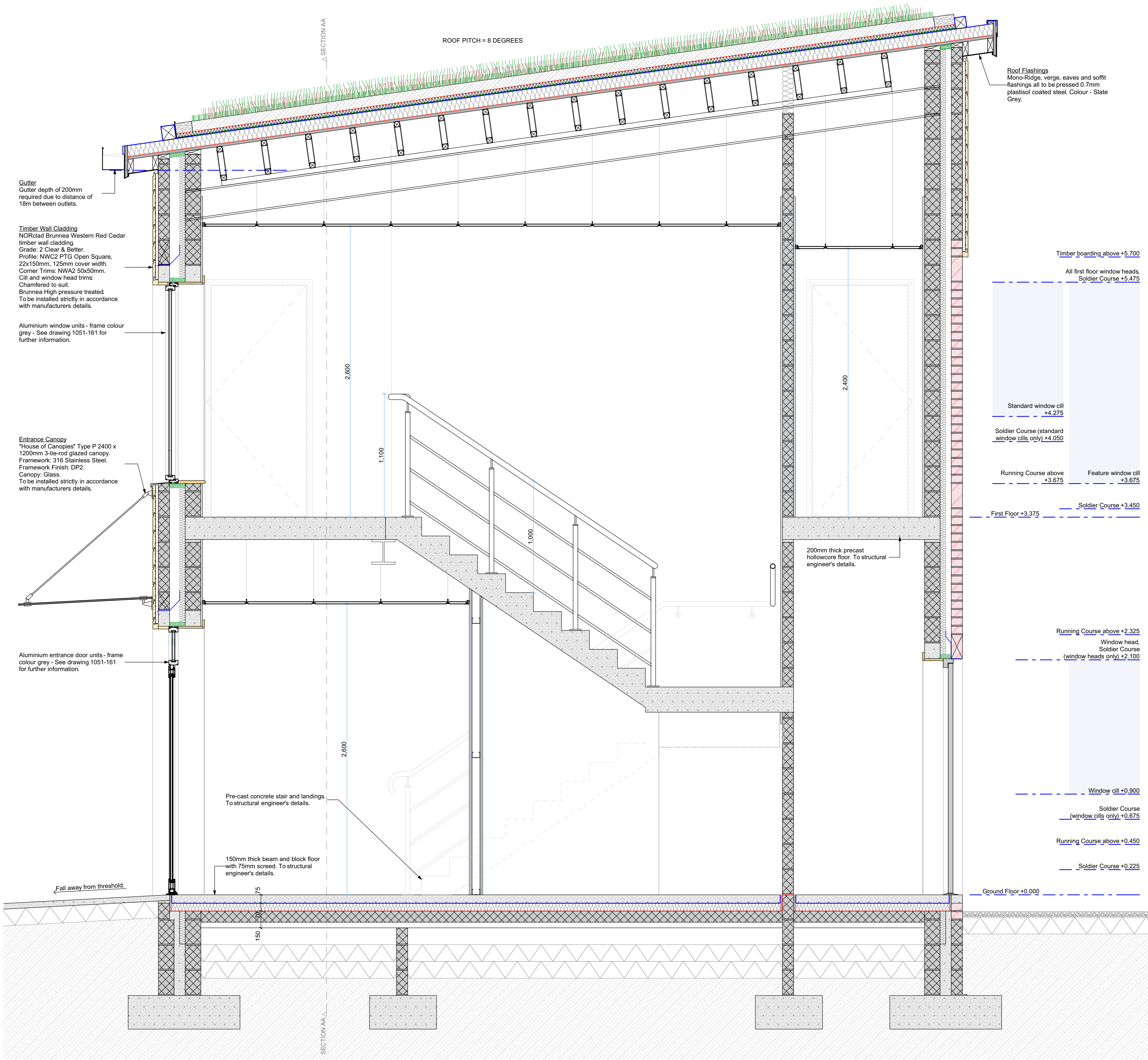
PROJECT MANAGEMENT
BIM / 3D RENDERING

Drawing Status
Tender - DRAFT

Scales	Size	Date
1:20	A1	Jan' 21

Drawing Number	Revision
1051 - 140	-

1051 - Dawley Road - Tender.rvt



Section BB
Scale 1:20

Roof Flashings
Mono-Ridge, verge, eaves and soffit
flashings all to be pressed 0.7mm
plastisol coated steel. Colour - Slate
Grey.

Timber boarding above +5.700

All first floor window heads,
Soldier Course +5.475

Standard window cill
+4.275

Soldier Course (standard
window cills only) +4.050

Running Course above
+3.675

Feature window cill
+3.675

Soldier Course +3.450

First Floor +3.375

Running Course above +2.325

Window head,
Soldier Course
(window heads only) +2.100

Window cill +0.900

Soldier Course
(window cills only) +0.675

Running Course above +0.450

Soldier Course +0.225

Ground Floor +0.000

Revision	Description	Date
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Client

abellio
london

Project

Proposed Depot for Abellio London
Dawley Road
Hayes, UB3 1EF

Drawing Title

Accom - Proposed Section BB

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ARCHITECTURAL DESIGN PROJECT MANAGEMENT
PRINCIPAL DESIGNER BIM / 3D RENDERING

Drawing Status Tender - DRAFT

Scales	Size	Date
1:20	A1	Jan' 21

Drawing Number	Revision
1051 - 141	-

3.3 Appendix C Greenfield Runoff Calculations

Calculated by:	Robin Turner
Site name:	Dawley Rd Bus Depot
Site location:	Hayes

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.51390° N
Longitude:	0.43638° W
Reference:	1040476561
Date:	Aug 11 2020 18:05

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	0.39
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Methodology

Q _{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	619	619
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q _{BAR} (l/s):	0.62	0.62
1 in 1 year (l/s):	0.52	0.52
1 in 30 years (l/s):	1.42	1.42
1 in 100 years (l/s):	1.96	1.96
1 in 200 years (l/s):	2.3	2.3

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

3.4 Appendix D Surface Water Drainage Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.900	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.001	5.00	38.447	1	508503.722	180545.831	0.400
2			38.447	1	508508.975	180529.669	0.500
3	0.066	5.00	38.594	1	508528.562	180536.299	0.500
4	0.033	5.00	38.706	1	508523.138	180551.468	0.799
5			38.762	1200	508526.398	180550.952	1.185
6			39.099	1200	508542.563	180556.702	1.740
7	0.122	5.00	38.770	1	508569.978	180551.171	0.500
8			38.858	1	508565.144	180568.311	1.596
9	0.007	5.00	39.058	1200	508573.051	180577.677	1.370
10	0.014	5.00	39.056	1200	508591.565	180584.730	1.238
11			39.121	1200	508584.326	180578.195	1.941
12	0.094	5.00	38.900	1	508603.803	180561.127	1.132
13		5.00	39.102	100	508586.257	180572.999	1.967
14			39.111	1200	508586.138	180576.279	1.982
15			38.978	1500	508598.748	180584.242	2.028
16			39.164	1500	508613.911	180577.339	2.298
16_OUT			37.975	1200	508626.760	180585.622	1.185

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	16.994	0.600	38.047	37.947	0.100	169.9	150	5.37	50.0
1.001	2	5	27.505	0.600	37.947	37.606	0.341	80.7	150	5.78	50.0
2.000	3	5	14.812	0.600	38.094	37.606	0.488	30.4	300	5.09	50.0
3.000	4	5	3.301	0.600	37.907	37.577	0.330	10.0	300	5.01	50.0
1.002	5	6	17.157	0.600	37.606	37.434	0.172	100.0	300	5.96	50.0
1.003	6	8	25.390	0.600	37.359	37.262	0.097	263.0	375	6.34	49.1
4.000	7	8	17.809	0.600	38.270	37.337	0.933	19.1	300	5.08	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	0.768	13.6	0.2	0.250	0.350	0.001	0.0
1.001	1.120	19.8	0.2	0.350	1.006	0.001	0.0
2.000	2.864	202.4	10.7	0.200	0.856	0.066	0.0
3.000	4.999	353.4	5.4	0.499	0.885	0.033	0.0
1.002	1.572	111.1	16.3	0.856	1.365	0.100	0.0
1.003	1.112	122.8	16.0	1.365	1.221	0.100	0.0
4.000	3.615	255.5	19.8	0.200	1.221	0.122	0.0

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.004	8	11	21.579	0.600	37.262	37.180	0.082	263.0	375	6.66	47.9
5.000	9	11	11.287	0.600	37.688	37.406	0.282	40.0	150	5.12	50.0
6.000	10	11	9.753	0.600	37.818	37.331	0.487	20.0	225	5.06	50.0
1.005	11	14	2.383	0.600	37.181	37.129	0.052	45.8	375	6.68	47.8
7.000	12	14	23.775	0.600	37.768	37.183	0.585	40.6	225	5.19	50.0
8.000	13	14	3.165	0.600	37.135	37.129	0.006	500.0	375	5.07	50.0
1.006	14	15	15.814	0.600	37.129	37.050	0.079	200.2	300	6.92	47.0
1.007	15	16	16.660	0.600	36.950	36.867	0.083	200.0	300	7.17	46.2
1.008	16	16_OUT	15.273	0.600	36.866	36.790	0.076	201.0	300	7.40	45.5

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.004	1.112	122.8	34.6	1.221	1.566	0.222	0.0
5.000	1.596	28.2	1.1	1.220	1.565	0.007	0.0
6.000	2.937	116.8	2.3	1.013	1.565	0.014	0.0
1.005	2.682	296.2	37.8	1.565	1.607	0.243	0.0
7.000	2.058	81.8	15.3	0.907	1.703	0.094	0.0
8.000	0.803	88.7	0.0	1.592	1.607	0.000	0.0
1.006	1.107	78.3	51.5	1.682	1.628	0.337	0.0
1.007	1.108	78.3	50.6	1.728	1.997	0.337	0.0
1.008	1.105	78.1	49.8	1.998	0.885	0.337	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	16.994	169.9	150	1 STANDARD	38.447	38.047	0.250	38.447	37.947	0.350
1.001	27.505	80.7	150	1 STANDARD	38.447	37.947	0.350	38.762	37.606	1.006
2.000	14.812	30.4	300	1 STANDARD	38.594	38.094	0.200	38.762	37.606	0.856
3.000	3.301	10.0	300	1 STANDARD	38.706	37.907	0.499	38.762	37.577	0.885
1.002	17.157	100.0	300	1 STANDARD	38.762	37.606	0.856	39.099	37.434	1.365
1.003	25.390	263.0	375	1 STANDARD	39.099	37.359	1.365	38.858	37.262	1.221
4.000	17.809	19.1	300	1 STANDARD	38.770	38.270	0.200	38.858	37.337	1.221
1.004	21.579	263.0	375	1 STANDARD	38.858	37.262	1.221	39.121	37.180	1.566
5.000	11.287	40.0	150	1 STANDARD	39.058	37.688	1.220	39.121	37.406	1.565
6.000	9.753	20.0	225	1 STANDARD	39.056	37.818	1.013	39.121	37.331	1.565
1.005	2.383	45.8	375	1 STANDARD	39.121	37.181	1.565	39.111	37.129	1.607

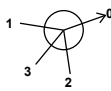
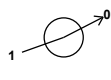
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1	Junction		2	1	Manhole	1 STANDARD
1.001	2	1	Manhole	1 STANDARD	5	1200	Manhole	1 STANDARD
2.000	3	1	Manhole	1 STANDARD	5	1200	Manhole	1 STANDARD
3.000	4	1	Manhole	1 STANDARD	5	1200	Manhole	1 STANDARD
1.002	5	1200	Manhole	1 STANDARD	6	1200	Manhole	1 STANDARD
1.003	6	1200	Manhole	1 STANDARD	8	1	Junction	
4.000	7	1	Manhole	1 STANDARD	8	1	Junction	
1.004	8	1	Junction		11	1200	Manhole	1 STANDARD
5.000	9	1200	Manhole	1 STANDARD	11	1200	Manhole	1 STANDARD
6.000	10	1200	Manhole	1 STANDARD	11	1200	Manhole	1 STANDARD
1.005	11	1200	Manhole	1 STANDARD	14	1200	Manhole	1 STANDARD

Pipeline Schedule

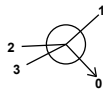
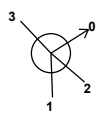
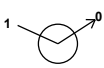
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
7.000	23.775	40.6	225	1 STANDARD	38.900	37.768	0.907	39.111	37.183	1.703
8.000	3.165	500.0	375	1 STANDARD	39.102	37.135	1.592	39.111	37.129	1.607
1.006	15.814	200.2	300	1 STANDARD	39.111	37.129	1.682	38.978	37.050	1.628
1.007	16.660	200.0	300	1 STANDARD	38.978	36.950	1.728	39.164	36.867	1.997
1.008	15.273	201.0	300	1 STANDARD	39.164	36.866	1.998	37.975	36.790	0.885

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
7.000	12	1	Manhole	1 STANDARD	14	1200	Manhole	1 STANDARD
8.000	13	100	Manhole	1 STANDARD	14	1200	Manhole	1 STANDARD
1.006	14	1200	Manhole	1 STANDARD	15	1500	Manhole	1 STANDARD
1.007	15	1500	Manhole	1 STANDARD	16	1500	Manhole	1 STANDARD
1.008	16	1500	Manhole	1 STANDARD	16_OUT	1200	Manhole	1 STANDARD

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
1	508503.722	180545.831	38.447	0.400	1		0	1.000	38.047	150
2	508508.975	180529.669	38.447	0.500	1		1	1.000	37.947	150
							0	1.001	37.947	150
3	508528.562	180536.299	38.594	0.500	1		0	2.000	38.094	300
4	508523.138	180551.468	38.706	0.799	1		0	3.000	37.907	300
5	508526.398	180550.952	38.762	1.185	1200		1	3.000	37.577	300
							2	2.000	37.606	300
							3	1.001	37.606	150
							0	1.002	37.606	300
6	508542.563	180556.702	39.099	1.740	1200		1	1.002	37.434	300
							0	1.003	37.359	375
7	508569.978	180551.171	38.770	0.500	1		0	4.000	38.270	300
8	508565.144	180568.311	38.858	1.596	1		1	4.000	37.337	300
							2	1.003	37.262	375
							0	1.004	37.262	375

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
9	508573.051	180577.677	39.058	1.370	1200	 0	5.000	37.688	150
10	508591.565	180584.730	39.056	1.238	1200	 0	6.000	37.818	225
11	508584.326	180578.195	39.121	1.941	1200	 1 2 3 0	6.000 5.000 1.004 1.005	37.331 37.406 37.180 37.181	225 150 375 375
12	508603.803	180561.127	38.900	1.132	1	 0	7.000	37.768	225
13	508586.257	180572.999	39.102	1.967	100	 0	8.000	37.135	375
14	508586.138	180576.279	39.111	1.982	1200	 3 2 1 0	8.000 7.000 1.005 1.006	37.129 37.183 37.129 37.129	375 225 375 300
15	508598.748	180584.242	38.978	2.028	1500	 1 0	1.006 1.007	37.050 36.950	300 300
16	508613.911	180577.339	39.164	2.298	1500	 1 0	1.007 1.008	36.867 36.866	300 300
16_OUT	508626.760	180585.622	37.975	1.185	1200	 1	1.008	36.790	300

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m ³ /ha)	20.0
Summer CV	0.900	Check Discharge Rate(s)	x
Winter CV	0.900	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	40	0	0

Node 14 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	37.129	Product Number	CTL-SHE-0058-2000-1800-2000
Design Depth (m)	1.800	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node 13 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	37.135
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	300.0	0.0	0.800	300.0	0.0	0.801	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.29%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	11	38.061	0.014	0.2	0.0007	0.0000	OK
15 minute summer	2	13	37.956	0.009	0.2	0.0000	0.0000	OK
15 minute summer	3	10	38.140	0.046	10.6	0.1221	0.0000	OK
15 minute summer	4	10	37.933	0.026	5.3	0.0212	0.0000	OK
15 minute summer	5	10	37.685	0.108	15.8	0.1217	0.0000	OK
15 minute summer	6	11	37.539	0.180	15.8	0.2034	0.0000	OK
15 minute summer	7	10	38.326	0.056	19.6	0.2717	0.0000	OK
15 minute summer	8	11	37.533	0.271	37.7	0.0000	0.0000	OK
15 minute summer	9	11	37.708	0.020	1.1	0.0250	0.0000	OK
15 minute summer	10	10	37.840	0.022	2.3	0.0295	0.0000	OK
15 minute summer	11	11	37.529	0.349	56.5	0.3944	0.0000	OK
15 minute summer	12	10	37.833	0.065	15.1	0.1079	0.0000	OK
960 minute summer	13	645	37.306	0.171	8.5	48.6856	0.0000	OK
15 minute summer	14	11	37.524	0.395	74.7	0.4469	0.0000	SURCHARGED
30 minute summer	15	18	36.978	0.028	1.4	0.0498	0.0000	OK
30 minute summer	16	18	36.894	0.028	1.4	0.0499	0.0000	OK
30 minute summer	16_OUT	18	36.818	0.028	1.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	0.2	0.393	0.014	0.0094	
15 minute summer	2	1.001	5	0.1	0.052	0.007	0.1306	
15 minute summer	3	2.000	5	10.5	0.994	0.052	0.1595	
15 minute summer	4	3.000	5	5.3	0.631	0.015	0.0422	
15 minute summer	5	1.002	6	15.8	1.045	0.142	0.3119	
15 minute summer	6	1.003	8	21.7	0.461	0.176	1.7454	
15 minute summer	7	4.000	8	19.5	1.661	0.076	0.5123	
15 minute summer	8	1.004	11	53.7	0.767	0.437	2.0731	
15 minute summer	9	5.000	11	1.1	0.672	0.039	0.0951	
15 minute summer	10	6.000	11	2.3	0.885	0.019	0.1895	
15 minute summer	11	1.005	14	62.4	0.749	0.210	0.2585	
15 minute summer	12	7.000	14	15.0	0.858	0.183	0.5854	
960 minute summer	13	8.000	14	-8.5	-0.308	-0.096	0.1583	
15 minute summer	14	1.006	15	1.4	0.428	0.018	0.0518	
30 minute summer	15	1.007	16	1.4	0.428	0.018	0.0545	
30 minute summer	16	1.008	16_OUT	1.4	0.427	0.018	0.0500	14.0

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.29%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	38.066	0.019	0.4	0.0009	0.0000	OK
15 minute summer	2	12	37.961	0.014	0.4	0.0000	0.0000	OK
15 minute summer	3	10	38.166	0.072	26.1	0.1903	0.0000	OK
15 minute summer	4	10	37.946	0.039	13.0	0.0323	0.0000	OK
15 minute summer	5	10	37.860	0.283	39.2	0.3200	0.0000	OK
15 minute summer	6	10	37.820	0.461	52.8	0.5213	0.0000	SURCHARGED
15 minute summer	7	10	38.357	0.087	48.2	0.4266	0.0000	OK
15 minute summer	8	10	37.814	0.552	107.6	0.0000	0.0000	SURCHARGED
15 minute winter	9	9	37.749	0.061	3.7	0.0755	0.0000	OK
15 minute summer	10	10	37.851	0.033	5.5	0.0449	0.0000	OK
15 minute summer	11	9	37.770	0.590	121.4	0.6675	0.0000	SURCHARGED
15 minute summer	12	10	37.889	0.121	37.1	0.2002	0.0000	OK
600 minute winter	13	585	37.550	0.415	9.5	118.3974	0.0000	SURCHARGED
15 minute summer	14	9	37.763	0.634	162.6	0.7165	0.0000	SURCHARGED
60 minute summer	15	55	36.978	0.028	1.4	0.0499	0.0000	OK
60 minute summer	16	56	36.894	0.028	1.4	0.0500	0.0000	OK
60 minute summer	16_OUT	56	36.818	0.028	1.4	0.0000	0.0000	OK

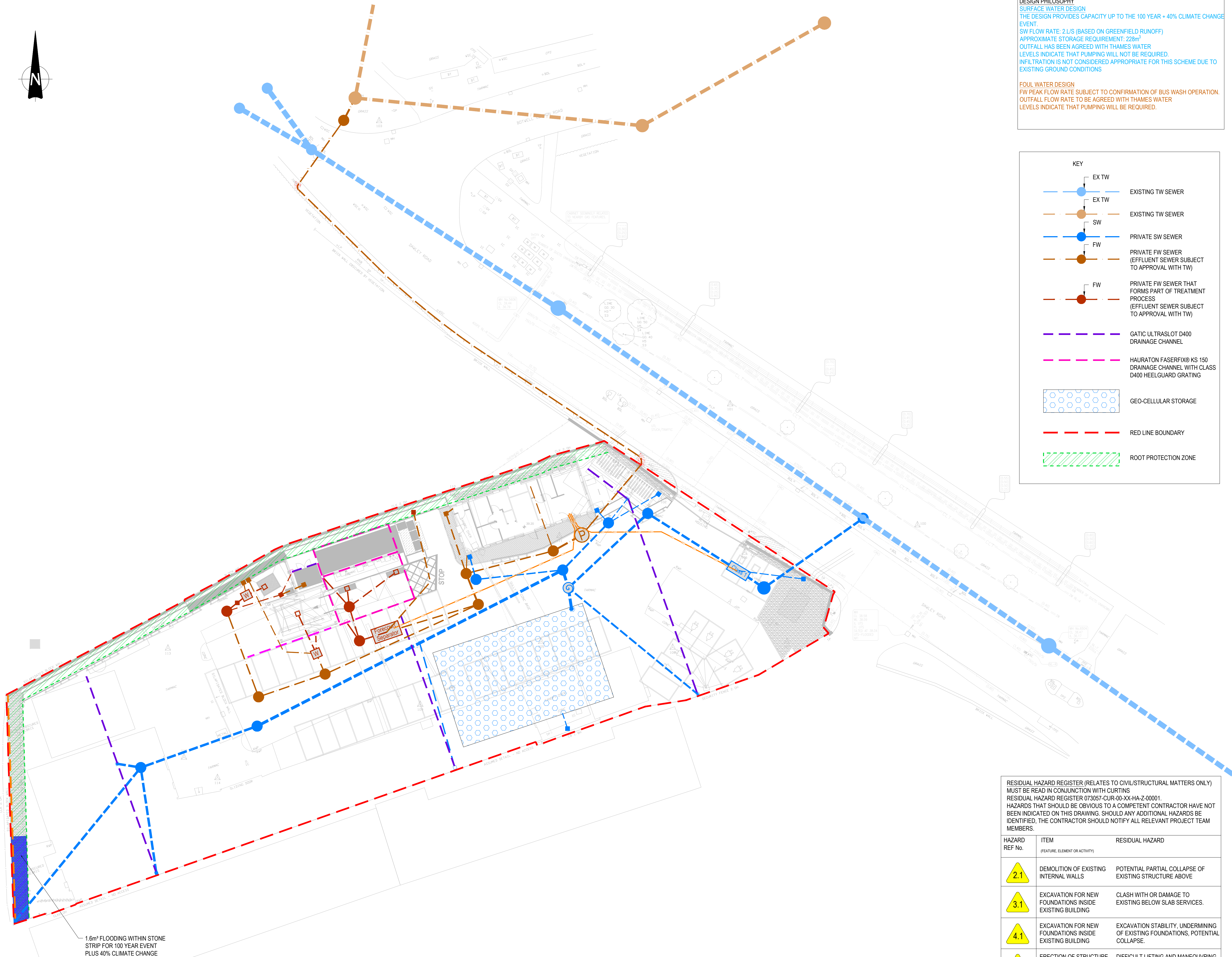
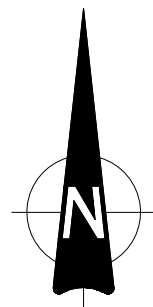
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	0.4	0.422	0.030	0.0175	
15 minute summer	2	1.001	5	0.4	0.069	0.019	0.2533	
15 minute summer	3	2.000	5	26.0	1.199	0.128	0.5672	
15 minute summer	4	3.000	5	13.0	0.614	0.037	0.1225	
15 minute summer	5	1.002	6	52.8	1.254	0.475	1.1497	
15 minute summer	6	1.003	8	61.4	0.627	0.500	2.8004	
15 minute summer	7	4.000	8	48.0	1.818	0.188	0.7788	
15 minute summer	8	1.004	11	113.4	1.047	0.923	2.3801	
15 minute winter	9	5.000	11	2.7	0.861	0.094	0.1375	
15 minute summer	10	6.000	11	5.5	0.993	0.047	0.2116	
15 minute summer	11	1.005	14	126.9	1.153	0.428	0.2628	
15 minute summer	12	7.000	14	37.4	1.073	0.457	0.7300	
600 minute winter	13	8.000	14	-9.5	-0.440	-0.108	0.3491	
15 minute summer	14	1.006	15	1.4	0.428	0.018	0.0517	
60 minute summer	15	1.007	16	1.4	0.428	0.018	0.0547	
60 minute summer	16	1.008	16_OUT	1.4	0.428	0.018	0.0502	24.5

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.29%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	1	870	38.447	0.400	0.2	0.0200	0.0000	FLOOD RISK
960 minute winter	2	870	38.447	0.500	0.8	0.0000	1.6770	FLOOD
960 minute winter	3	870	38.448	0.354	2.8	0.9358	0.0000	FLOOD RISK
960 minute winter	4	870	38.448	0.541	1.4	0.4473	0.0000	FLOOD RISK
960 minute winter	5	870	38.448	0.871	4.2	0.9857	0.0000	SURCHARGED
960 minute winter	6	870	38.449	1.090	4.2	1.2324	0.0000	SURCHARGED
960 minute winter	7	870	38.449	0.179	5.1	0.8731	0.0000	OK
960 minute winter	8	870	38.449	1.187	9.0	0.0000	0.0000	SURCHARGED
960 minute winter	9	870	38.449	0.761	0.3	0.9383	0.0000	SURCHARGED
960 minute winter	10	870	38.449	0.631	1.0	0.8562	0.0000	SURCHARGED
960 minute winter	11	870	38.449	1.269	9.5	1.4352	0.0000	SURCHARGED
960 minute winter	12	870	38.449	0.681	4.0	1.1313	0.0000	SURCHARGED
960 minute winter	13	870	38.449	1.314	12.0	228.1530	0.0000	SURCHARGED
960 minute winter	14	870	38.449	1.320	17.0	1.4928	0.0000	SURCHARGED
960 minute winter	15	885	36.981	0.031	1.7	0.0550	0.0000	OK
960 minute winter	16	885	36.897	0.031	1.7	0.0551	0.0000	OK
960 minute winter	16_OUT	885	36.820	0.030	1.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute winter	1	1.000	2	-0.2	0.012	-0.012	0.2992	
960 minute winter	2	1.001	5	-0.8	-0.044	-0.039	0.4842	
960 minute winter	3	2.000	5	2.8	0.696	0.014	1.0431	
960 minute winter	4	3.000	5	1.4	0.243	0.004	0.2325	
960 minute winter	5	1.002	6	4.2	0.726	0.038	1.2082	
960 minute winter	6	1.003	8	3.9	0.317	0.031	2.8004	
960 minute winter	7	4.000	8	5.1	1.273	0.020	1.0172	
960 minute winter	8	1.004	11	8.6	0.498	0.070	2.3801	
960 minute winter	9	5.000	11	0.3	0.458	0.011	0.1987	
960 minute winter	10	6.000	11	-0.8	0.682	-0.007	0.3879	
960 minute winter	11	1.005	14	13.7	0.480	0.046	0.2628	
960 minute winter	12	7.000	14	4.0	0.630	0.049	0.9456	
960 minute winter	13	8.000	14	-12.0	-0.451	-0.135	0.3491	
960 minute winter	14	1.006	15	1.7	0.456	0.022	0.0598	
960 minute winter	15	1.007	16	1.7	0.456	0.022	0.0630	
960 minute winter	16	1.008	16_OUT	1.7	0.455	0.022	0.0578	88.5

3.5 Appendix E Flood Exceedance Plan



1.6m³ FLOODING WITHIN STONE STRIP FOR 100 YEAR EVENT PLUS 40% CLIMATE CHANGE

DESIGN PHILOSOPHY
SURFACE WATER DESIGN
THE DESIGN PROVIDES CAPACITY UP TO THE 100 YEAR + 40% CLIMATE CHANGE EVENT.
SW FLOW RATE: 2 L/S (BASED ON GREENFIELD RUNOFF)
APPROXIMATE STORAGE REQUIREMENT: 228m³
OUTFALL HAS BEEN AGREED WITH THAMES WATER
LEVELS INDICATE THAT PUMPING WILL NOT BE REQUIRED.
INFILTRATION IS NOT CONSIDERED APPROPRIATE FOR THIS SCHEME DUE TO EXISTING GROUND CONDITIONS

FOUL WATER DESIGN
FW PEAK FLOW RATE SUBJECT TO CONFIRMATION OF BUS WASH OPERATION.
OUTFALL FLOW RATE TO BE AGREED WITH THAMES WATER
LEVELS INDICATE THAT PUMPING WILL BE REQUIRED.

KEY

- EX TW (blue dashed line with blue dot) EXISTING TW SEWER
- EX TW (orange dashed line with orange dot) EXISTING TW SEWER
- SW (blue dashed line with blue dot) PRIVATE SW SEWER
- FW (brown dashed line with brown dot) PRIVATE FW SEWER (EFFLUENT SEWER SUBJECT TO APPROVAL WITH TW)
- FW (red dashed line with red dot) PRIVATE FW SEWER THAT FORMS PART OF TREATMENT PROCESS (EFFLUENT SEWER SUBJECT TO APPROVAL WITH TW)
- GATIC ULTRASLOT D400 DRAINAGE CHANNEL (purple dashed line)
- HAURATON FASERFIX® KS 150 DRAINAGE CHANNEL WITH CLASS D400 HEELGUARD GRATING (pink dashed line)
- GEO-CELLULAR STORAGE (blue hatched area)
- RED LINE BOUNDARY (red dashed line)
- ROOT PROTECTION ZONE (green hatched area)

GENERAL NOTES:

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
- DESIGN BASED ON TOPOGRAPHICAL SURVEY AND CCTV SURVEY INFORMATION AVAILABLE AT THE TIME OF DESIGN.
- ALL EXISTING SEWERS, CONNECTIONS, PIPE SIZES AND INVERT LEVELS TO BE CONFIRMED BY CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS TO ENSURE CONNECTIVITY. ANY VARIANCE FROM THE INFORMATION SHOWN SHOULD BE REPORTED TO THE ENGINEER FOR REVIEW.
- DO NOT SCALE THIS DRAWING. ANY AMBIGUITIES, OMISSIONS AND ERRORS ON DRAWINGS SHALL BE BROUGHT TO THE ENGINEERS ATTENTION IMMEDIATELY. ALL DIMENSIONS MUST BE CHECKED / VERIFIED ON SITE.
- ALL DIMENSIONS ARE IN METRES AND LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS OTHERWISE NOTED.
- ALL EXISTING SERVICES TO BE LOCATED PRIOR TO COMMENCEMENT OF ANY DRAINAGE WORKS, AND WHERE NECESSARY PROTECTION OR DIVERSIONS TO BE UNDERTAKEN TO AVOID CONFLICT WITH THE PROPOSED WORK.
- ALL RAINWATER AND FOUL POP UPS LOCATIONS AND SIZES ARE TO BE CONFIRMED BY THE ARCHITECT AND M&E ENGINEER.
- COVER LEVELS, INVERT LEVELS, GULLY POSITIONS, AND BUILDINGS LOCATION ARE APPROXIMATE AND SHALL BE CONFIRMED BY ARCHITECT/ LANDSCAPE ARCHITECT.
- NOTE *. PUMPING STATION SIZE, 24 HOUR STORAGE AND FLOW RATES ARE PROVISIONAL. STORAGE SIZE, RISING MAIN SIZE AND PUMP FLOW RATE MAY VARY DEPENDING ON FINAL BUS WASH OPERATION AND RECYCLING SYSTEM WHICH IS STILL TO BE AGREED.

P01	ISSUED FOR PLANNING	16/02/21	MB	RT
Rev:	Description:	Date:	By:	Chkd:

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Status: **ISSUED FOR PLANNING**

Project: **DAWLEY ROAD BUS DEPOT**

Orig Title: **FLOOD EXCEEDANCE PLAN**

Size:	Date:	Drawn By:	Designed By:	Checked By:			
A1	16/03/21	MB	RT	RT			
Scale: 1:250							
Project No:	Originator:	Volume:	Level:	Type:	Role:	Category / Number:	Rev:
076625 - CUR - XX - XX - DR - C - 92002 - P01							

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